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ABSTRACT

Reported is an instrument, the Science Student Observation Instrument (SSOI), designed for use in activity-centered science classes in desegregated urban junior high schools. Use of the instrument will enable the observer to compare classroom behaviors of black and white students, to determine the extent of interracial interactions, and to determine whether achievement is related to student behavior. (PB)

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Science Student Observation Instrument

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Syracuse University, 1981

The Science Student Observation Instrument was developed for use in a study of classroom process variables in activity-centered science classes in desegregated urban junior high schools. The purposes of the study were to compare classroom behaviors of black and white males, to determine the extent of interracial interactions in the classroom, and to determine whether achievement in these classes was related to student behavior.

Development of Instrument

A search was made for an observation instrument that would meet the requirements of the study. There have been two general lines of research using data collected by means of direct classroom observation. The first has concentrated on teacher behaviors and has asked questions about the relation of teacher behavior to student gains in knowledge or changes in attitude. The second line of research has related student behaviors to student gains, using a model of teaching that assumes more autonomy on the part of the student. The study that we undertook fell within the latter category.

Since our focus was on individual students in classrooms employing activity-centered instructional methods, as represented by the Intermediate Science Curriculum Study (ISCS) program, we needed an instrument with behavior categories that would accurately characterize the student behaviors in these classrooms. In our review of the instruments available we found a number that were designed for science classrooms and several that focused on individual students and, in some cases, simultaneously on the teacher (Simon and Boyer, 1974; Power, 1977). Among the instruments that we reviewed were those by Matthews and Phillips (1968), Lindvall (#48 in Mirrors of Behavior), Steen, Lipe and Quirk (1969), and Stallings (1978). Although all of these had some attractive characteristics, we did not find one that focused on junior high school students in activity-centered programs and used the student as the unit of analysis. The instrument that we found most useful was a Scheme for Analyzing Behavior in Individualized Classrooms (SABIC) (Tisher and Power, 1974). This system was developed for use with the Australian Science Education Project, a curriculum that has many similarities to ISCS.

It was this instrument which provided a basis for the categories of behavior used in the construction of our own instrument. The behaviors included in the Science Student Observation Instrument were chosen after careful consideration of the behavior categories in SABIC, the student behaviors expected by the ISCS developers and our own observations of what was occurring in these classrooms. Our goal was to construct a low inference instrument with a small but inclusive set of meaningful behaviors which could be used to characterize accurately the important student behaviors in activity-centered classrooms.

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Throughout the developmental process, we were aware of the criticisms of observational instruments made by Brown, Mendehall and Beaver (1968), McGaw, Wardrop and Bunda (1972), Herbert and Attridge (1975), Shavelson and Dempsey-Atwood (1976), and Frick and Semmel (1978), and tried to avoid the methodological flaws noted by these writers.

The instrument (see Appendix A) makes use of an on-site time sampling technique and has features common to most time-sampling instruments (Fischler and Zimmer, 1968). These features are: (a) the behaviors are predefined; (b) trained observers make and record on-site observations; (c) the behaviors of each subject are observed for a definite length of time; (d) each subject is observed several different times; and (e) the data for each subject are the frequencies of each behavior category occurring during a specific time interval. The instrument uses a multiple category coding system in which the behaviors under the categories are observed and recorded during specified time intervals. The time interval used is 12 seconds. This interval is divided into a five-second interval for observing followed by a five-second interval for recording. Two seconds are used by statements and tones. Data are collected by recording the occurrences of specific, pre-defined, low inference, observable categories of student behaviors. Each observed behavior is recorded by placing the code of the behavior on a coding sheet under the time interval number and beside the description of the target. Observations of subjects are not made during the first and last six minutes of each class period.

Throughout each period of observation, the observers carry a small tape recorder with a single earplug to listen to the time interval instructions. A recorded voice gives the number of the interval on the recording sheet, followed by a first electronic tone (high) which is the signal for the five-second observational interval. At the end of this interval, a second electronic tone (low) indicates the beginning of a five-second recording interval. During the recording interval, the observers record behaviors exhibited by the subject. More than one behavior may be recorded for a given interval. A total of 30 observational intervals and corresponding recording intervals are made in each six minutes of observation of one subject. At the end of the six minutes and after changing the coding sheet, the observer begins observing the next subject.

Training of Observers

In the first stage, observers became familiar with the categories and definitions of the behaviors to be coded. Next, they were taught to code the behaviors and to use a tape recording to determine the time intervals. Instructions and specific ground rules for the use of the instrument were given. Discussions were held each week on the clarity and adequacy of the definitions, possible changes to increase objectivity, and the progress of each observer in learning the definitions and mechanics of using the instrument. The observers participated in refining the categories and definitions.

In the second stage of the process, the observers used the instrument to observe and record in regular classes and in a simulated junior high school activity-centered class. During the observation of the simulated class, each observer coded behaviors as they occurred during the same time interval. A video tape was made and used for later discussion. The purpose of this stage of training was to learn to identify and categorize behaviors.

During the third stage, the observers used the observational instrument in classrooms of a suburban school district in which an activity-centered science program was being used. The enitre observation procedure was followed. A discussion about the results of the observations and coding was conducted each week. Problem areas were clarified or revised. The observers began to compare codings on individual students. This was a first step toward establishing inter-observer agreement.

In stage four, each observer was assigned to the school in which most of his or her observations would be made. Observers received information about the school, the classroom space, the names of the subjects and order of observation, and other pertinent information about the collection of the data. An introductory period of data collection followed in which all of the procedures for gathering data were used, but the data were discarded. The presence of the observers in the classrooms gave the members of the class an opportunity to become accustomed to the presence of an observer, with the result that the observers later became virtually unnoticed in the classroom. Meanwhile, this period gave the observers an opportunity to become familiar with the classroom procedures and an opportunity to identify their subjects.

Inter-Observer Agreement

During the introductory period, inter-observer agreement was obtained. One trainer was used as a standard and all of the observers were rated against that person. The agreement was obtained by using the following formula:

$$P = \frac{A}{A + D} \times 100$$

where P equals percentage of agreement, A equals the number of recorded codes that were in agreement, and D equals the number of recorded codes that were different. These data were obtained by simultaneous coding of the behaviors of one subject by a "standard observer" and a trainee, using one tape with a dual jack for earplugs.

Inter-observer agreements were computed twice for each observer during the period in which the data were collected, and are reported in Table 1. The mean percentage of agreement for all observers over both computations of agreement was 87%. Except for periods in which inter-observer agreement was being calculated, each observer worked alone.

TABLE 1

Inter-Observer Agreements

Observer	Agreement 1	Agreement 2	Average
1	92	84	88
2	90	88	89
3	80	80	80
4	94	95	95
5	94	95	95
6	77	77	77

Reliability

Data were collected on 52 male subjects for ten 6-minute observations each. Prior to analysis of the observation data each behavior category was examined for frequency, variability and reliability. Although it had been possible for observers to reach 80% inter-observer agreement using 19 behavior codes, some behaviors occurred very infrequently (e.g., negative student interactions) or were exhibited by few students and were thus not reliable. Others seemed to the observers to be so closely related in student intent (e.g., both experimenting and observing indicate an intent to learn) that the distinctions between them were not useful. Therefore, all behaviors were collapsed into three broad categories as follows:

1. Learning: observing, experimenting, discussion of classwork initiated by subject or others, reading/writing, taking a test, listening.

2. Attending: preparing, waiting, copying.

3. Nonattending: disengaged, physical interactions (positive or negative), verbal interactions unrelated to classwork (positive or negative) initiated by subject or others.

Frequencies of behaviors in each of the three categories were calculated for each subject for each 6-minute observation period.

In order for behavior to be a useful variable in making predictions or establishing relationships, it has to be shown to be a stable characteristic of the learner under the conditions studied. Therefore it is important to have an index of reliability of observed behavior over time. For this purpose correlation coefficients were computed between number of behaviors in each category exhibited in the first five observations with the number of behaviors in each category exhibited in the second five observations. This resulted in correlations of .50 for active learning, .59 for passive attending, and .56 for nonattending (all $p < .01$).

APPENDIX A

SCIENCE STUDENT OBSERVATION INSTRUMENT

Behavior Categories

1. Preparing/returning (Pr) -- gathering and returning of materials; sharpening pencil; getting paper or pencil; walking associated with gathering and returning.

2. Observing (O) -- looking at someone perform a task for the purpose of learning the concept associated with the task; listening to other students while observing.

3. Experimenting (E) -- the manipulation of apparatus according to instructions; related reference to book; related talk; related observation; waiting for outcome of experiment.

4. Discussion (D) -- talk related to task performance with peer or teacher; questioning; follow-up of questions; information giving; answering teacher's questions; stopping to talk about task; teacher called on student (D) .

5. Reading/writing (Rw) -- attention focused on reading or writing; using pen/pencil to record; teacher checking students' written material; taking test [Rw] .

6. Copying (C) -- looking at another person's paper and writing down what is seen.

7. Listening (L) -- listening to teacher speak to the class or group listening to explanation; listening to lecture or demonstration presented by teacher; writing notes on presentation or demonstration by teacher (listening and observing).

8. Waiting (Wa) -- waiting for the teacher's attention (walking toward and away); waiting for materials or for someone to move or finish.

9. Conversing (Cv) -- talking about subject unrelated to task; stopping to talk, not task related; discipline by the teacher (Cv-) . Positive (+) or negative (-).

10. Touching (T) -- physical contact, such as hitting, jabbing, hugging, putting hands on, etc.; throwing things at someone. Positive (+) or negative (-).

11. Disengaged (Dg) -- out of contact with people, ideas, classroom situation; daydreaming; looking around the room at other people, not related to task; temporary cessation of activity; pondering; walking around the room, non-task related; picking up things; pretending to work; handling materials but not performing task; reading non-task related materials; throwing things in room; not listening or writing when instructed.

Notes: Target initiated (Code)

Taking test [Rw]

SSOI - Behavior Coding Sheet

Date _____ Subject _____ ( )*

Period _____ Observer _____

School _____ Teacher _____

Interval

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Subject																														
Black Boy																														
Black Girl																														
White Boy																														
White Girl																														
Teacher																														
Group																														
Class																														

CODE: Preparing/returning (Pr)
Observing (O)
Experimenting (E)
Discussing (D)
Reading/writing (Rw)
Copying (C)
Listening (L)
Waiting (Wa)
Conversing (Cv)
Touching (T)
Disengaged (DG)

* Race of subject

SSOI - BEHAVIOR SUMMARY SHEET

Subject Summary of the Frequencies of Behaviors for One Observation Period

Date _____ Observer _____

Subject _____ Teacher _____

Behaviors

Targets*	1 Pr	2 O	3 E	4 D	5 D	6 Rw	7 Rw	8 C	9 L	10 Wa	11 Cv+	12 Cv+	13 Cv-	14 Cv-	15 T	16 T	17 T-	18 T-	19 Dg
Subject																			
Black boy																			
Black girl																			
White boy																			
White girl																			
Others (boy)																			
Others (girl)																			
Teacher																			
Group																			
Class																			
TOTALS																			

* Person(s) with whom subject interacts

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